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Total number of printed pages – 3

B. Tech  
HSSM 3302

**Fifth Semester Regular Examination – 2014**

**OPTIMIZATION IN ENGINEERING**

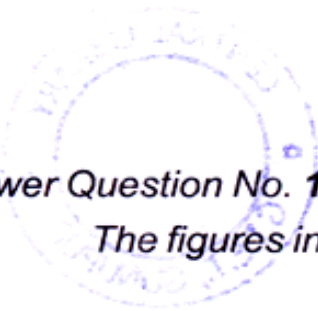
**BRANCH(S) : AEIE, CHEM, EC, ETC, IEE**

**QUESTION CODE : H 210**

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. 1 which is compulsory and any five from the rest.  
The figures in the right-hand margin indicate marks.*



1. Answer the following questions : 2 × 10
- Explain degeneracy in L.P.P.
  - Write the difference between dual simplex and simplex algorithm.
  - Explain the role of duality in linear programming.
  - Explain various steps involved in solving a transportation problem by applying the North West corner rule.
  - Show that assignment model is a special case of transportation model.
  - Explain the single channel and multi channel queueing models.
  - Write the transition diagram for M/M/3/3 model.
  - What are the primary uses of Kuhn-Tucker necessary and sufficient conditions ?
  - What is the advantage of Golden search method over Fibonacci search method ?
  - What are the basic advantages of genetic algorithm.

**P.T.O.**

2. (a) Solve the following LPP using simplex method : 5

$$\begin{aligned} \text{Minimize } & Z = 4x_1 + 8x_2 + 3x_3 \\ \text{subject to } & 2x_1 + x_2 \geq 2 \\ & 2x_1 + x_3 \geq 5 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

- (b) In a LPP : 5

$$\begin{aligned} \text{Minimize } & Z = 3x_1 + 5x_2 \\ \text{subject to } & x_1 + x_2 \leq 1 \\ & 2x_1 + 3x_2 \leq 1 \\ & x_1, x_2 \geq 0 \end{aligned}$$

Obtain the variation in  $c_j$  ( $j = 1, 2$ ) which are permitted without changing the optimal solution.



3. (a) Using duality, solve the following : 6

$$\begin{aligned} \text{Minimize } & Z = 5x_1 - 2x_2 + 3x_3 \\ \text{subject to } & 2x_1 - 2x_2 - x_3 \geq 2 \\ & 3x_1 - 4x_2 \leq 3 \\ & x_2 + 2x_3 \leq 5 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

- (b) Customers arrive at a sales counter managed by a single person, according to a Poisson law with a mean rate of 20 per hour. The time required to serve a customer has an exponential distribution with mean of 100 seconds. Find the average waiting time of a customer. 4

4. Using revised simplex method to solve the following LPP : 10

$$\begin{aligned} \text{Maximize } & Z = -2x_1 - 4x_2 - x_3 \\ \text{subject to } & x_1 + 2x_2 - x_3 \leq 5 \\ & 2x_1 - x_2 + 2x_3 = 2 \\ & -x_1 + 2x_2 + 2x_3 + x_4 \geq 1 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

5. (a) Solve the following Transportation problem to maximize the profit : 5

Origin/Source	A	B	C	D	E	Availability
1	3	4	6	8	9	20
2	2	10	1	5	8	30
3	7	11	20	40	3	15
4	2	1	9	14	16	13
Demand	40	6	8	18	6	

- (b) The company X has four plants each of which can manufacture any one of the four products. Product costs differ from one plant to another as follows :

		Product			
		1	2	3	4
Plant	1	42	35	28	21
	2	30	25	20	15
	3	30	25	20	15
	4	24	20	16	

Find out which product each plant should produce to minimize cost. 5

6. (a) If a factory maintains an average in-process equivalent to 300 work orders or jobs and an average job spends 6 weeks in the factory. What is the production rate of the factory in units of jobs per year? 5
- (b) Use the Golden section search method to minimize the function : 5

$$\text{Min } f(x) = 3x^4 + (x - 1)^2, 0 \leq x \leq 4.$$

7. Solve the quadratic programming problem : 10

$$\begin{aligned} \text{Maximize } & f(x) = x_1^2 - x_1x_2 + 3x_2^2 - 4x_2 + 4 \\ \text{subject to } & x_1 + x_2 \leq 1 \\ & x_1, x_2 \geq 0 \end{aligned}$$

8. Write notes on the following : 5×2

- (a) Markovian Queueing Model  
 (b) Fibonacci search method.